BUILDING PANEL AND CONSTRUCTION METHOD

The invention relates to a building panel and a method of building using said panel. In particular, although not exclusively, the invention relates to a building panel that may be connected with one or more like panels to construct a structure such as a wall, floor, ceiling, fence or the like.

BACKGROUND TO THE INVENTION

In the construction industry, walls, floors, ceilings and the like may be constructed using a wide variety of techniques. For example, walls may be constructed using conventional bricks held together with mortar, which is placed between adjacent bricks and between adjacent, alternately staggered layers of brickwork. However, this process is time-consuming, labour intensive, expensive, and often requires a large amount of preparation before, and finishing after, the wall or the like is formed.

One alternative to conventional bricks are mortarless bricks or blocks, such as the concrete mortarless blocks disclosed in United States Patent US 6,189,282 assigned to Building Works Inc.. To construct, for example, a wall, the concrete blocks are placed directly on top of each other without staggering alternate layers such that cavities or cavities extending through the depth of the blocks are aligned. Each block comprises a pair of locking channels at each end. Adjacent blocks and adjacent layers of blocks are secured together by inserting locking members into apertures formed by the locking channels of adjacent blocks. Concrete, or other settable material, may then be poured directly into the cavities to reinforce the wall. Steel reinforcing

members may be additionally inserted vertically and/or horizontally into the wall structure through horizontally and vertically disposed passages.

This system allows the concrete to pass relatively uninhibited through the aligned cavities thus reducing the risk of creating voids within the cavities unoccupied by concrete. This system is also quicker than the conventional bricks and mortar method described above since the blocks can be aligned directly on top of each other and do not require a layer of mortar between adjacent blocks or layers thereof. However, time is still wasted in having to directly align the blocks and insert the locking members into the locking channels. Furthermore, the blocks are of a comparable size to bricks and therefore a substantial amount of time is needed to complete even a fairly small sized wall. Concrete blocks are also heavy compared with conventionally sized bricks and therefore building walls and the like with such blocks is still labour intensive. The prior art is replete with such blocks utilizing various shapes of locking channel and locking member, yet all share the aforementioned drawbacks.

An alternative to the aforementioned bricks and blocks for constructing walls, floors and the like are building panels. Many types of building panels have a large surface area and therefore, one advantage of using building panels is that large areas of wall, ceiling and the like can be constructed in a shorter period of time compared with construction times using bricks and blocks. However, any reduction in construction time achieved using panels is dependent on, inter alia, the amount of preparation required in advance of fixing the panels.

Conventionally, a wooden frame, boxing or formwork must first be constructed to which various types of panelling, such as plasterboard, weatherboard or the like may in some manner be affixed. Hence, erection of walls, ceiling and/or floors or the like cannot proceed until the formwork is in place. Furthermore, fixing and positioning of the formwork and panelling needs to be carefully coordinated to enable services such as gas, electricity and water to route the necessary conduits therefor between the formwork and panelling. These factors serve to substantially reduce any time saved using conventional building panels.

One type of building panel and a method of construction using such panels is disclosed in United States Patent 5,397,516 assigned to Thermo Cement Engineering Corp., which discloses generally square shaped cementitious panels used as an inner and outer skin of a wall, between which a skeleton of steel reinforcing rods is arranged. Concrete may then be poured between the cementitious panels thus encasing the steel.

Apart from the production process for the panels disclosed in US 5,397,516 being somewhat laborious, the resulting panels are heavy and difficult to manoeuvre in a construction environment, resulting in minimal timesavings, if any, in using the panels. Another drawback of this construction method is that pouring of concrete within the cavity between the panels often does not achieve 100% filling of the cavity due to the formation of voids. Indeed, with many prior art construction systems, up to about 30% of the cavity can remain unfilled with concrete.

Further problems of many prior art panel systems are their complex design, such as the building panel and connection system disclosed in United

States Patent 6,314,704, assigned to American Structural Composites, Inc., and the consequently high cost. Many of the interlocking systems also fail to easily and/or neatly lock together. In many cases, users of such systems have to modify the interlocking mechanisms in order to fit the components together in a satisfactory manner. Furthermore, many panels, although providing structural integrity for a wall, floor or ceiling or the like, do not comprise either an interior and/or exterior finished surface. Therefore, additional time and expense is required to achieve a finished, presentable surface.

A yet further problem of many of the prior art systems is that they are not waterproof and therefore an additional waterproof membrane is necessary. Such membranes are often susceptible to puncturing, which renders the membrane useless, and therefore additional protection for the membrane itself is required.

Hence, there is a need for a building system and/or method that addresses, or at least ameliorates, at least some, if not all of the aforementioned problems. In particular, there is a need for a building system and/or method that can be used to efficiently construct walls, floors and/or ceilings or the like, which is easy to handle and fit together, requiring the minimum of expertise.

DISCLOSURE OF THE INVENTION

In one form, although it need not be the only or indeed the broadest form, the invention resides in a building panel comprising:

a plurality of spaced apart walls forming a plurality of cells;

apertures in said walls such that said walls forming each said cell include at least two apertures;

a substantially planar skin disposed adjacent and substantially perpendicular to said walls such that said cells are open on a side opposite said planar skin; and

a projection extending beyond at least one perimeter portion of said walls.

Suitably, said projection is formed by a portion of said skin.

The skin may have a beveled edge. Preferably, the beveled edge is provided on at least two opposite edges of the skin.

Suitably, the panel may comprise a slot along a perimeter portion of the length and/or the width of the panel, said slot sized and shaped to receive said projection of an adjacent panel.

Suitably, said slot may lie partially or continuously along a length and/or width of the panel.

The skin preferably covers the same area as the panel, but is preferably offset relative to the panel.

Preferably, the cells have a square cross section, but may suitably be rectangular, hexagonal, circular, or any other desired shape.

Suitably, the walls and the skin are rigid.

Preferably, the apertures in the walls are aligned and are preferably adapted to facilitate the passage therethrough of reinforcing members, conduits, pipes, cables and the like.

Suitably, the panel may comprise perimeter walls, which together define a quadrilateral. Particularly, the perimeter walls together may define a

rectangle.

Further features of the building panel will become apparent from the detailed description.

In another form, the invention resides in a method of constructing a building structure in a particular orientation from a plurality of building panels, each building panel comprising:

a plurality of spaced apart walls forming a plurality of cells;

apertures in said walls such that said walls forming each said cell include at least two apertures;

a substantially planar skin disposed adjacent and substantially perpendicular to said walls such that said cells are open on a side opposite said planar skin; and

a projection extending beyond at least one perimeter portion of said walls;

said method including the steps of:

securing a first panel in said orientation; and

abutting a second panel against said first panel such that the projection of the first panel overlaps the second panel.

Suitably, a beveled edge of the skin of the first panel abuts against a beveled edge of the skin of the second panel. Alternatively, a slot of the second panel accommodates the projection of the first panel.

Preferably, the apertures in the walls of the first panel align with corresponding apertures in the walls of said second panel.

The method may further include the step of securing said first and second panels together with fastening means.

The method may further include the steps of securing a third and further panels to said first and/or second panels.

Preferably, the method further includes the step of routing one or more reinforcing members through the aligned apertures of said walls.

Suitably, the method further includes the step of filling at least one cell with settable material.

The method may further include the step of placing one or more inserts in one or more of the cells prior to filling the cells with settable material to prevent ingress of the settable material to said cell(s) containing the insert(s).

The method may further include the step of routing one or more conduits, pipes, cables or the like through the aligned apertures of the walls.

In another form, the invention resides in a method of constructing a building structure in a particular orientation from a plurality of building panels, each building panel comprising:

a plurality of spaced apart walls forming a plurality of cells;

apertures in said walls such that said walls forming each said cell include at least two apertures;

a substantially planar skin disposed adjacent and substantially perpendicular to said walls such that said cells are open on a side opposite said planar skin; and

a projection extending beyond at least one perimeter portion of said walls;

said method including the steps of:

securing a first of said building panels in said orientation; and

securing a second of said building panels in said orientation spaced

apart from said first building panel.

The method may further comprise the step of securing said second building panel such that said plurality of cells of said second panel face said plurality of cells of said first panel.

The method may further comprise the step of coupling said first and second building panels with reinforcing members.

Further features of the methods of the present invention will become apparent from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

To assist in understanding the invention and to enable a person skilled in the art to put the invention into practical effect preferred embodiments of the invention will be described by way of example only with reference to the accompanying drawings, wherein:

FIG 1 shows a perspective view of a building panel in accordance with a first embodiment of the present invention;

FIG 2 shows a first sectional view of the building panel in FIG 1;

FIG 3 shows a second sectional view of the building panel in FIG 1;

FIG 4 shows a plan view of the building panel in FIG 1;

FIG 5 shows a construction method using a plurality of the building panels shown in FIG 1;

FIG 6 shows another construction method using a plurality of the building panels shown in FIG 1;

FIG 7 shows a perspective view of a building panel in accordance with a second embodiment of the present invention;

FIG 8 shows a partial side view of two of the building panels in FIG 7 coupled together;

FIG 9 shows a further construction method using a plurality of the building panels shown in FIG 7; and

FIG 10 shows another partial side view of two of the building panels in FIG 7 coupled together.

DETAILED DESCRIPTION OF THE INVENTION

A building panel 2 in accordance with the present invention is shown in FIG 1. In a first embodiment, the building panel comprises a plurality of spaced apart walls 4 arranged such that they create a plurality of cells or cavities 10. The cells 10 can be clearly seen, for example, in the perspective views in FIGS 1 and 5 and in the plan view of the panel in FIG 4.

In the embodiment shown in FIG 1, the panel comprises a first set 6 of substantially parallel, spaced apart walls lying substantially perpendicular to a second set 8 of substantially parallel, spaced apart walls. An example of one of the walls constituting the first set 6 of walls is depicted in FIG 2. An example of one of the walls constituting the second set 8 of walls is depicted in FIG 3.

It will become apparent that the present invention is not limited to the walls 4 of the panel 2 being arranged in the manner shown in FIG 1. For example, the walls need not be arranged substantially perpendicular to each other and could instead be arranged at some other relative angle whilst maintaining the inventive function of the panel.

Also, the cells 10 are not limited to having a square cross section. The cells 10 may be of any shape that allows the easy passage of conduits and the like through apertures therein, as described below. The cells should also be of a shape that allows containment of settable material within the cell once the material has set. Hence, it is envisaged that the cells could be rectangular, triangular, circular, hexagonal, or any other desired shape.

The walls 4 of the panel 2 comprise a plurality of apertures 12, as

shown particularly in FIG 2 and FIG 3. The apertures 12 are preferably of various diameters to allow the passage therethrough of reinforcing members, such as steel reinforcing rods, and conduits, wires, pipes, cables and the like for services such as gas, electricity, water and air conditioning. The apertures 12 in the walls comprising the first set 6 are aligned with each other to enable a straight pipe or the like to be easily routed through the panel 2, passing through each wall in the first set of walls. The apertures in the walls comprising the second set 8 are also aligned with each other for the same reason. Hence, cables, conduits and the like may be routed through the panel in any desired manner. An example of the alignment of the apertures 12 in the walls 4 is clearly shown in FIG 4.

FIGS 2 and 3 show just one assortment of aperture diameters in two different configurations. However, it will be appreciated that the present invention is not limited to the diameter of the apertures selected, the number of apertures per wall or the configuration of the apertures. The diameter, number and configuration of the apertures may be selected according to the particular application for which the panel is being used and a second embodiment of the panel comprising a different aperture arrangement and configuration is described hereinafter. However, the aperture diameters can be selected to allow the easy passage of conduits, piping, or the like therethrough, whilst securely maintaining the conduits and the like in position. Furthermore, the apertures are not limited to being circular in shape and may be shaped according to the cross-sectional shape of the conduit or the like to be passed therethrough. Hence, for example, the apertures may be of any regular or irregular polygon or other shape to allow passage therethrough of

conduits, pipes, reinforcing members or the like of that shape. However, corresponding sets of apertures 12 in first and second wall sets are at different levels to enable reinforcing members and/or utility conduits or the like to be routed through the panel without being impeded by other reinforcing members and/or utility conduits or the like passing through the panel in, for example, a perpendicular direction.

The building panel 2 also comprises a substantially planar skin or planar surface 14 on one face of the panel. The skin 14 may be of the same area as that enclosed by the perimeter walls 16, but offset with respect to the perimeter walls 16 such that the skin 14 forms a projection 15 extending beyond at least one of the perimeter walls 16. Preferably, the skin 14 extends beyond two of the perimeter walls, as shown in the embodiment shown in, for example, FIGS 1 and 4. The skin 14 is positioned with respect to the walls 4 such that the skin seals one side of many of the cells 10, with the opposite side of the cell being open. Some of the cells, such as cell 10a, are only partially covered on one side by the skin 14, as shown in FIG 4.

The offset of the skin 14 relative to the walls 4 enables a plurality of panels 2 to be accurately aligned with each other in the construction of a wall, floor, ceiling, fence or the like using the panels, as described later herein. Accurate and snug alignment of the panels is further facilitated by beveled edge 18 of the skin 14, most clearly visible in FIG 3. The bevel may be angled at substantially 45 degrees to the plane of the skin 14, although other angles may alternatively be selected. Other angles may be preferred depending on the application for which the panels are being used. The beveled edge 18 is provided on at least two opposite edges of the skin 14,

such that the beveled edges 18 on the opposite edges are parallel. The beveled edges may also be provided on the remaining two opposite edges of the skin 14, the angles of the edges on the remaining opposite edges again being parallel.

Construction of, for example, a wall using the panels of the present invention will now be described.

The panels 2 may be set in, for example, a conventional concrete foundation. A first panel may be aligned at the desired angle, which conventionally will be substantially vertical in the case of a wall structure. Alternatively, the first panel may be placed in any orientation corresponding to the desired orientation of the resultant wall, floor, or the like. The first panel may be set with either the longer side or the shorter side running vertically and the selected orientation for the first panel will determine the orientation of the other panels forming, in this example, the wall. Once a first panel is positioned, subsequent panels can be positioned adjacent the first panel. Accurate and snug alignment is achieved by virtue of the projection 15 of the skin 14 and the beveled edge 18, as described above.

With reference to FIG 5, when two panels are brought adjacent each other, the projection 15 of a first panel 2a abuts the skin 14 of a second panel 2b. Part of the walls of panel 2b rest on the projection 15 of the panel 2a, such as parts of the walls defining cell 10a. The overlap of portions of the walls 4 of panel 2b with the projection 15 of adjacent panel 2a contributes to the structural integrity of the wall, floor or the like, constructed from the panels and creates an effectively continuous skin for the walls 4.

Once two adjacent panels are correctly aligned and positioned, they

may be joined together with any conventional fastening means applicable to the material from which the panels are formed, which is discussed later herein. The panels may be, for example, glued, clipped, bolted or screwed together using any suitable fastening means that securely holds the panels in position and the present invention is not limited to the type of fastening means employed.

Depending on the particular application, once a number of panels are fixed in position as described above, reinforcing members, such as steel reinforcing rods 20, as shown in FIG 5, may be passed through the appropriate apertures in the panel in a vertical and/or horizontal direction. Conduits, pipes, cables and the like may also be passed through the desired apertures. The apertures selected depend on the service(s) being routed through the panel and, for example, the location in the panel at which, for example, service outlets, are required. For example, apertures suitable for e.g., water pipes may be present at, for example, 100mm intervals along the panel 2. Hence, there is a large degree of flexibility in where services are routed through each panel, thus addressing one of the problems exhibited by the prior art building systems.

Alternatively, once the reinforcing members have been inserted through the panel, the relevant services personnel may choose not to route the relevant service conduits or the like through the panel at that time, but delay until a later time. In this case, to prevent the desired cells from being filled with concrete or other settable material, an insert, such as a polystyrene or polyurethane block or the like may be inserted into those cells required for routing the services. The inserts can then easily be removed later, thus

leaving a vacant cell.

In the case of passing wires or cables through the panel when concrete or other settable material is also going to be used, conduits for the wires may be passed through the relevant apertures 12. Wires can then be threaded through the conduits and replaced at a later date with ease, if and when necessary.

Another advantage of the present invention over the prior art is exhibited when concrete or other settable material is used. All of the cells 10 of the panel 2 are open on one side to allow the uninhibited access for concrete or the like, thus minimizing the prior art problem of voids being created and concrete not completely filling the relevant cells. The apertures 12 in the walls 4 further facilitate communication of the concrete or the like throughout the panel 2 into the desired cells 10.

The panels of the present invention may be used for single or multiple thickness walls, floors, fences, ceilings or the like. Application of the panels of the present invention in a double thickness wall will now be described with reference to FIG 6.

Using the panels of the present invention, two single thickness walls 30, 32 may be constructed parallel to each other, each wall being constructed as described above for the single thickness wall. The two walls may be constructed with the cells 10 of each wall facing each other, such that the skins 14 of each wall face away from each other. Reinforcing members, such as steel reinforcing rods 20, may then be passed through the apertures 12 of the walls 4 horizontally and/or vertically. With reference to FIG 6, loops 34 of reinforcing material, such as steel reinforcing rods, may be looped around the

horizontal and/or vertical reinforcing members of each wall 30, 32 to both secure the two walls together and to act as spacers between the two walls. The loops 34 of reinforcing material may be over-looped as shown to prevent running of the looped rod. Conventional ties may also be employed to help prevent the loops from pulling apart. This arrangement prevents movement of the two walls relative to each other and the cell openings are still accessible to concrete or other settable material that may be subsequently poured between the two walls to provide further reinforcement.

It will be appreciated that the invention is not limited to the particular reinforcing members around which the loops 34 are passed. With reference to FIG 6, the loops 34 may alternatively or additionally be looped around reinforcing rods running through the panel closer to the skin 14, such as reinforcing rods running through aperture 36. In such a case, loops 34 extend further into the cells 10. Therefore, when concrete or the like is poured into the cells, the loops 34 are embedded in a greater depth of concrete, thus providing greater strength.

Another embodiment of the panel of the present invention is shown in FIGS 7, 8 and 10 and another construction method using these panels in accordance with the present invention is shown in FIG 9. Like reference numerals refer to like features of the first embodiment and construction method.

Building panel 2 comprises a plurality of spaced apart walls 4 arranged such that they create a plurality of cells or cavities 10. A first set 6 of substantially parallel, spaced apart walls lie substantially perpendicular to a second set 8 of substantially parallel, spaced apart walls. Substantially planar

skin or substantially planar surface 14 is positioned with respect to the walls 4 such that the skin seals one side of many of the cells 10, with the opposite side of the cell being open. Some of the cells, such as cell 10a, are only partially covered on one side by the skin 14, as shown in FIG 7.

Walls 4 of the panel 2 comprise a plurality of apertures 12. The apertures may be in the form of apertures 40 in second wall set 8 and be of any desired shape and/or size to allow the passage therethrough of reinforcing members, such as steel reinforcing rods, and conduits, wires, pipes, cables and the like for services such as gas, electricity, water and air conditioning as described above. The apertures may alternatively be in the form of apertures 42 in second wall set 8, apertures 42 being open at one end and substantially forming a U-shape. Similar shaped apertures 44 may also be present in first wall set 6. The U-shaped apertures are most clearly visible in FIGS 8-10. However, the apertures 42, 44 are clearly not limited to substantially forming a U-shape and may have any desired shape to accommodate the reinforcing members and/or utility conduits or the like routed through the panel.

Apertures 12 in the walls comprising the first set 6 are aligned with each other to enable a straight pipe or the like to be easily routed through the panel 2, passing through each wall in the first set of walls. The apertures in the walls comprising the second set 8 are also aligned with each other for the same reason. Hence, cables, conduits and the like may be routed through the panel in any desired manner.

Apertures 40, 42, 44 are at different levels above skin 14 to enable reinforcing members and/or utility conduits or the like to be routed through the

panel without being impeded by other reinforcing members and/or utility conduits or the like passing through the panel in, for example, a perpendicular direction.

The substantially planar skin 14 forming one face of the panel extends beyond a perimeter portion of first walls 6 and/or second walls 8. In this embodiment, perimeter portions are in the form of ends 46 of first walls 6 and ends 48 of second walls 8. Skin 14 may extend beyond the perimeter portion of first walls 6 at least at one end of the panel. Alternatively, or additionally, skin 14 may extend beyond the perimeter portion of second walls 8 at least at one end of the panel.

With reference to FIGS 7 and 8, a projection 15 extends beyond a perimeter portion of first walls 6 and/or second walls 8. Projection 15 may lie partially or continuously along a length or width respectively of one side of the panel. Preferably, projections 15 extend beyond perimeter portions of both first and second walls 6, 8 respectively, as shown in FIG 7. Preferably, projections 15 lie along a full length and a full width of the panel, as shown in FIG 7.

With reference to FIGS 7 and 8, a slot 50 is formed in the panel along a perimeter portion of a length and/or width of the panel 2. Slot 50 is sized and shaped to receive projection 15 of another panel, as shown in FIG 8, to facilitate fitting together and alignment of adjacent panels. Slot 50 may lie partially or continuously along a length and/or width respectively of the panel and will correspond to the continuous or partial nature of the projection(s) 15.

With reference to FIG 10, slot 50 in panel 2a accommodates projection 15 of adjacent panel 2b. Slot 50a of panel 2b accommodates projection 15a

of panel 2a. Recess 52 of panel 2b accommodates projection 15b of panel 2a.

Referring to the embodiment in FIG 8, adjacent panels fit together such that the number of apertures 44 in first walls 6 is the same for each cell 10. Similarly, with reference to FIG 10, the number of apertures 40, 42 in second walls 8 is the same for each cell. Ends 46 of first walls 6 and ends 48 of second walls 8 are shaped such that when two adjacent panels abut, apertures 44a are formed in first walls 6, as shown in FIG 8, and/or apertures 42a are formed in second walls 8, as shown in FIG 10, where two adjacent panels abut. The panels of the second embodiment may be secured together by the same means as the first embodiment as described above.

FIG 9 shows the construction of a wall or the like using panels of the second embodiment. In this example, apertures 40 of second walls 8 overlap. Reinforcing members and/or utility conduits and the like may be passed through these apertures. Overlapping the panels in this manner enables a strong wall or the like. With such a wall, the wall doesn't occupy as much volume as some prior art alls of comparable strength and therefore realizes larger room spaces. It will be appreciated that panels of the second embodiment need not be overlapped in this manner to produce walls, ceilings, or the like. The panels may be space apart and reinforcing loops may alternatively be employed. Of course, walls, floors and the like may be produced using single layers of panels according to the second embodiment.

The panels 2 of the present invention may be produced from any suitable plastics material, which is preferably recycled plastic, in accordance with any suitable methods know to those skilled in the relevant art. More than

600 known different grades of plastics may be used for the panels. Alternatively, conventional aluminium or other metals or metal composites may be used for the panels if required for particular applications. Alternatively, the panels may be produced from alternative materials, e.g., for more lightweight applications. When produced from suitable plastics material, a panel according to the invention of dimensions 600x1200mm has a mass of only about 4-5kg, making the panels very easy to maneuver. The panels may also be made from fire retardant materials and/or have soundproofing characteristics, the level of each being selectable according to the materials from which the panels are manufactured.

The panels may be produced to the required dimensions and shape as determined by the particular application. For example, although the panel is shown in the drawings as substantially rectangular in shape, the perimeter walls 16 of the panel 2 may define a square, a quadrilateral or any other shape appropriate for the application, providing the panels tessellate and allow for the routing of reinforcing members, conduits and the like easily therethrough, as described above.

The skin 14 of the panel may be produced to any desired thickness, which also may be selected according to the application. In particular, since the skin of the panels may serve as the finished surface, visible once construction is complete, the skin may be protected against ultraviolet radiation in accordance with known methods to resist deterioration of the skin when exposed to sunlight. The skin may comprise any form of finish such as a powder coating as desired, including any desired colour and/or texture. The particular finish will depend on the application and the material from which the

panel is formed. The compatibility of the finish and the material will be familiar to one skilled in the relevant art.

Hence, the panel of the present invention addresses another problem of the prior art. Since the skin may act as the finished surface, no further work needs to be carried out, or materials used, on the skin. The skin is also waterproof, thus obviating the need for an additional waterproof membrane and associated protection.

Where the panels are produced from, for example, plastics materials or metals, the panels do not absorb moisture, for example, from the settable material used with the panels, which is a problem associated with some of the prior art panels. Therefore, the settable material can set naturally without having moisture extracted therefrom by the panels, which could jeopardize the strength and integrity of the settable material.

Furthermore, the snug and accurate alignment of the panels results in only a fine, virtually imperceptible line delineating adjacent panels, thus resulting in an aesthetically pleasing surface finish. The panels are also vermin proof, which is a major consideration in many environments.

The panels of the present invention are easy to manoeuvre due to their lightweight construction and their non-complex design avoids the alignment and interlocking problems of the prior art.

The construction methods for double thickness walls according to the present invention also enables the overall wall thickness to be less than conventional double thickness walls, allowing larger internal floor spaces to be realized. This can be achieved by virtue of looping the reinforcing members in the manner described above or by overlapping of the panels as shown in FIG

9.

The strength of the paneling is achieved by virtue of the combination of the panel walls, the grid of reinforcing members passing through the walls and the efficient filling of the cells with concrete or other settable material, which minimizes the existence of strength reducing voids within the concrete.

A further advantage of the panels of the present invention over much of the prior art is their simplicity of use. A wall or the like may be erected efficiently using the panels of the present invention without a large degree of expertise. Consequently, the Applicants estimate that approximately 50 metres of wall approximately 3 metres in height may be erected per day using the panels of the present invention in accordance with the described method.

Throughout the specification the aim has been to describe the invention without limiting the invention to any one embodiment or specific collection of features. Persons skilled in the relevant art may realize variations from the specific embodiments that will nonetheless fall within the scope of the invention.